EZStream enhancements will include (1) extensions that enable the server to receive and process arbitrary data streams on its own and (2) a Web-based graphical-user-interface-building subprogram that enables a client who lacks programming expertise to create customized display Web pages.

This program was written by Gerry Myers and Jim Chamberlain of AZ Technology, Inc., for **Marshall Space Flight Center**. *For further information, contact the company's New Technology Representative, David O'Neil, at (256) 837-9877. MFS-31836*

Autonomous Environment-Monitoring Networks

These neural networks recognize novel features in streams of input data.

NASA's Jet Propulsion Laboratory, Pasadena, California

Autonomous environment-monitoring networks (AEMNs) are artificial neural networks that are specialized for recognizing familiarity and, conversely, novelty. Like a biological neural network, an AEMN receives a constant stream of inputs. For purposes of computational implementation, the inputs are vector representations of the information of interest. As long as the most recent input vector is similar to the previous input vectors, no action is taken. Action is taken only when a novel vector is encountered. Whether a given input vector is regarded as novel depends on the previous vectors; hence, the same input vector could be regarded as familiar or novel, depending on the context of previous input vectors. AEMNs have been proposed as means to enable exploratory robots on remote planets to recognize novel features that could merit closer scientific attention. AEMNs could also be useful for processing data from medical instrumentation for automated monitoring or diagnosis.

The primary substructure of an AEMN is called a spindle. In its simplest form, a spindle consists of a central vector (**C**), a scalar (r), and algorithms for changing **C** and r. The vector **C** is constructed from all the vectors in a given continuous stream of inputs, such that it is minimally distant from those vectors. The scalar r is the distance between **C** and the most remote vector in the same set.

The construction of a spindle involves four vital parameters: setup size, spindle-population size, and the radii of two novelty boundaries. The setup size is the number of vectors that are taken into account before computing **C**. The spindle-population size is the total number of input vectors used in constructing the spindle — counting both those that arrive before and those that arrive after the computation of **C**. The novelty-boundary radii are distances from **C** that partition the neighborhood around **C** into three concentric regions (see Figure 1). During construction of the spindle, the changing spindle radius is denoted by h. It is the final value of h, reached before beginning construction on the next spindle, that is denoted by r.

During construction of a spindle, if a new vector falls between **C** and the inner boundary, the vector is regarded as completely familiar and no action is taken. If the new vector falls into the region between the inner and outer boundaries, it is considered unusual enough to warrant the adjustment of **C** and r by use of the aforementioned algorithms, but not unusual enough to be considered novel. If a vector falls outside the outer boundary, it is considered novel, in which case one of several appropriate responses could be initiation of construction of a new spindle.

An AEMN comprises a collection of spindles that represent a typical history or range of behaviors of a system that one seeks to monitor. An AEMN can be represented as a familiarity map, on which successive spindles are represented by adjacent circles that are added as construction proceeds. A familiarity map could be simple or complex, depending on the monitored system. For example, the range of behaviors of a complex system might be represented by a networklike familiarity map that could even include dead-end branches that lead to the demise of the system. An automated monitoring system based on the AEMN corresponding to the familiarity map could recognize that the system was

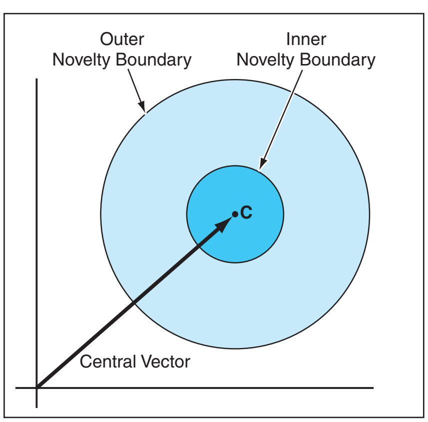

Figure 1. The **Central Vector and The Novelty Boundaries** play major roles in the construction of a spindle.

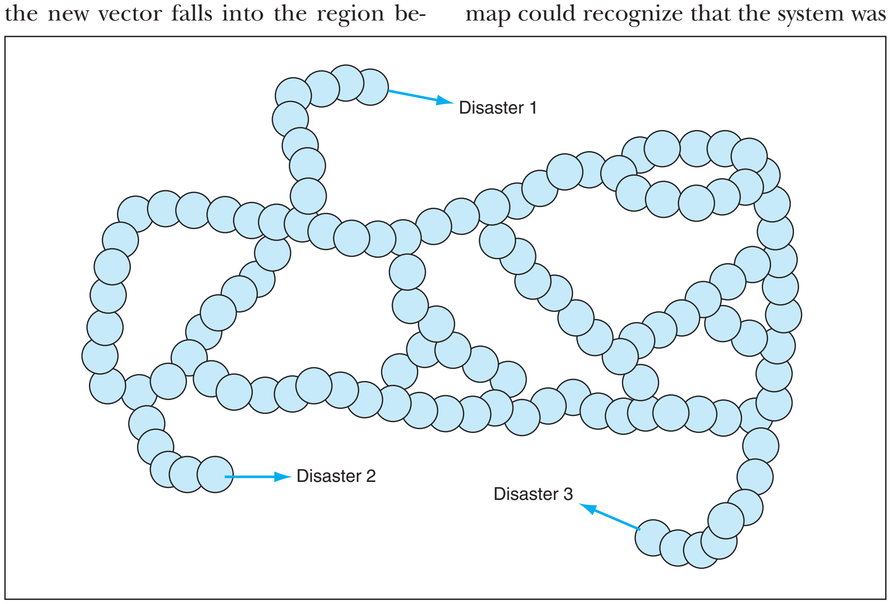

Figure 2. A **Familiarity Map** comprises a sequence of overlapping circles that represent spindles constructed from data acquired in observation or simulation of a system to be monitored.

progressing along a dead-end branch and respond by generating an alarm or triggering control action to move the system away from the dead-end condition.

This work was done by Charles Hand of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

This software is available for commercial licensing. Please contact Don Hart of the California Institute of Technology at (818) 393-3425. Refer to NPO-30408.

Readout of DSN Monitor Data

NASA's Jet Propulsion Laboratory, Pasadena, California

DSN Monitor Data Reader is a computer program that, as its name suggests, reads file of monitor data from the Deep Space Network (DSN). The monitor data constitute information on the status and performance of tracking, telemetry, command, and pointing equipment at the DSN antennas. The DSN has recently introduced a new, more advanced monitor data format, denoted 0158-Mon, that is based on the standard formatted data unit (SFDU) and compressed header data objects (CHDO) of the Consultative Committee for Space Data Systems (CCSDS). The 0158-Mon data format is a very flexible generic format that provides for specific variable-length formats and for self-identifying parameters that obviate the proprietary NASA Communications (NASCOM) bit-packed formats of the past. The monitor data SFDUs are also encapsulated in Standard DSN Blocks and routed to DSN customers for processing at their local mission control centers. This program helps a DSN customer to read and parse the monitor data to assess the statuses of the DSN stations in support of spacecraft flight operations.

This program was written by Katherine Levister and May Tran of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*

This software is available for commercial licensing. Please contact Don Hart of the California Institute of Technology at (818) 393-3425. Refer to NPO-30723.